PATENT ABSTRACTS OF JAPAN

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(71)Applicant : SONY CORP
(72)Inventor : KOBAYASHI SEIJI

(54) OPTICAL INFORMATION RECORDING DEVICE, OPTICAL INFORMATION RECORDING METHOD, OPTICAL INFORMATION RECORDING MEDIUM, AND OPTICAL INFORMATION REPRODUCING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To record an identification code which can be read by a reproducing device and in which normal information used by a user is not spoiled in an optical information recording medium together with normal information.
SOLUTION: The optical information recording device 1 recording digital information in the optical information recording medium 2 by modulating recording light L irradiating the optical information recording medium 2 is provided with a first modulation signal generating means 13 generating a first modulation signal S2 by switching a signal level with a period of integral multiple of the prescribed fundamental period in accordance with a first digital information D1 a second modulation means 57 generating a double modulation signal SC by modulating the first modulation signal S2 further in accordance with a second digital information SC1 other than the first digital information D1, and a recording light modulation means 8 modulating the recording light L conforming to this double modulation signal SC.

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CLAIMS

[Claim(s)]
[Claim 1] In the optical information recording device which records digital information on said optical information record medium by modulating the record light which irradiates an optical information record medium By changing signal level with the period of the integral multiple of a predetermined primitive period according to the first digital information By adding a modulation to said first modulating signal further according to the second digital information other than the first modulating-signal creation means which creates the first modulating signal, and said first digital information The optical information recording device characterized by having the second modulation means which creates a double modulation signal, and a record light modulation means to modulate said record light according to said double modulation signal.
[Claim 2] It is the optical information recording apparatus characterized by being constituted by timing change means by which said second modulation means modulates the timing of level change of said first modulating signal in an optical information recording apparatus according to claim 1.
[Claim 3] The optical information recording device characterized by setting the amount of modulations of the timing by said timing change means to said 10% or less of primitive period in an optical information recording device according to claim 2.
[Claim 4] It is the optical information recording apparatus characterized by said timing change means modulating the timing of at least ten or more level change among said first modulating signal corresponding to 1-bit change of the arbitration of said second digital information in an optical information recording apparatus according to claim 2 or 3.
[Claim 5] It is the optical information recording device which the binary number

sequence sign arithmetic circuit which produces a predetermined binary number sequence sign is prepared in the optical information recording device according to claim 2 to 4, and is characterized by both said second digital information and said binary number sequence sign opting for actuation of said timing change means.

[Claim 6] In the optical information record approach which records digital information on said optical information record medium by modulating the record light which irradiates an optical information record medium By changing signal level with the period of the integral multiple of a predetermined primitive period according to the first digital information By creating the first modulating signal and modulating the timing of level change of said first modulating signal according to the second digital information other than said first digital information The optical information record approach characterized by creating a double modulation signal and modulating said record light according to said double modulation signal.

[Claim 7] The optical information record approach characterized by setting the amount of modulations of said timing to said 10% or less of primitive period in the optical information record approach according to claim 6.

[Claim 8] The optical information record approach characterized by modulating the timing of at least ten or more level change among said first modulating signal corresponding to 1-bit change of the arbitration of said second digital information in the optical information record approach according to claim 6 or 7.

[Claim 9] The optical information record approach characterized by generating a predetermined binary number sequence sign and opting for modulation actuation of said timing in the optical information record approach according to claim 6 to 8 with both said second digital information and said binary number sequence sign.

[Claim 10] In the optical information record medium with which digital information was recorded by forming the truck which consists of a pit or a mark So that the regenerative signal with which the first digital information changes with the period of the integral multiple of a predetermined primitive period may be acquired It is recorded by changing the die length or spacing of said pit or a mark. The optical information record medium characterized by recording the second digital information other than said first digital information by moving the location of said pit, the first transition of a mark, or a trailing edge from the location determined by said first digital information.

[Claim 11] The optical information record medium characterized by the movement magnitude of said pit, the first transition of a mark, or a trailing edge being said 10% or less of primitive period in an optical information record medium according to claim 10.

[Claim 12] The optical information record medium characterized by the movement magnitude of said pit, the first transition of a mark, or a trailing edge being 10nm or less in an optical information record medium according to claim 10 or 11.

[Claim 13] In the optical information regenerative apparatus which reproduces digital information from said optical information record medium based on the output of the

optical reading means according to the amount of reflected lights from an optical information record medium A binary-ized means to make the output of said optical reading means binary, and a clock generation means to generate a clock signal based on the output of said binary-ized means, The first decode means which decodes the first digital information based on the output of said binary-ized means, It is based on the output of said optical reading means, said clock signal, and the output of said binary-ized means. It has the second decode means which decodes the second digital information other than said first digital information. Said second decode means The optical information regenerative apparatus characterized by including a changing point location detection means to detect time fluctuation of the changing point of the output of said binary-ized means, and an equalization means to average the output of said changing point location detection means.
[Claim 14] counting which carries out counting of the count of accumulation in an accumulation means to by_which said equalization means accumulates the output of said changing point location detection means, and said accumulation means, in an optical information regenerative apparatus according to claim 13 -- the output value of a means and said accumulation means -- said counting -- the optical information regenerative apparatus characterized by to consist of division means which do a division by the enumerated data of a means.
[Claim 15] It is the optical information regenerative apparatus characterized by to consist of multiplication means which carry out the multiplication of a sampling means to by_which said changing point location detection means samples the changing point of the output of said binary-ized means in an optical information regenerative apparatus according to claim 13 or 14, a binary number sequence sign generation means generate a predetermined binary number sequence sign, and the value of said binary number sequence sign and the output value of said sampling means.
[Claim 16] It is the optical information recording apparatus characterized by said second digital information including the information for discernment of an optical information record medium in an optical information recording apparatus according to claim 1 to 5.
[Claim 17] In the optical information record approach according to claim 6 to 9 Said second digital information is the optical information record approach characterized by including the information for discernment of an optical information record medium.
[Claim 18] It is the optical information record medium characterized by said second digital information including the information for discernment of an optical information record medium in an optical information record medium according to claim 10 to 12.
[Claim 19] It is the optical information regenerative apparatus characterized by said second digital information including the information for discernment of an optical information record medium in an optical information regenerative apparatus according to claim 13 to 15.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is applicable to optical disk regenerative apparatus, such as optical disks, such as a recording device used for creation of optical disks, such as a compact disk (CD), and the record approach, a compact disk, and a compact disk player, concerning an optical information recording device, the optical information record approach, an optical information record medium, and an optical information regenerative apparatus.
[0002]
[Description of the Prior Art] Conventionally, in the compact disk which is a kind of an optical information record medium, the sign which shows a manufacturer, a factory place, a disk number, etc. for the purpose, such as discernment of a disk, was stamped on the part inside the field where the usual information used by users, such as an audio signal and TOC (Table Of Contents), is recorded. Moreover, the approach of recording such an identification code as a pattern which can be viewed on a signal record section is also proposed.
[0003]
[Problem(s) to be Solved by the Invention] The identification code which shows a manufacturer, a factory place, a disk number, etc. which are recorded by these approaches was not what can recognize by viewing and can read regenerative apparatus, such as a compact disk player. For this reason, while saying that the contents of these identification codes could be made to reflect in the motion control of a regenerative apparatus, and there was nothing (for example, playback of an audio signal etc. cannot be suspended even if it is a compact disk concerning an illegal copy), there was a title.
[0004] Therefore, the purpose of this invention is based on a regenerative apparatus, read it, and ** Li is possible for it. And the optical information recording device and the optical information record approach of recording an identification code which does not spoil the usual information used by the user on an optical information record medium with the usual information, Such an identification code is to offer the optical information regenerative apparatus which can reproduce an identification code with the usual information from the optical information record medium recorded with the usual information, and such an optical information record medium.
[0005]
[Means for Solving the Problem] In the optical information recording apparatus which

records digital information on an optical information record medium when the optical information recording apparatus concerning this invention modulates the record light which irradiates an optical information record medium The first modulating-signal creation means which creates the first modulating signal by changing signal level with the period of the integral multiple of a predetermined primitive period according to the first digital information, It is characterized by having the second modulation means which creates a double modulation signal, and a record light modulation means to modulate record light according to this double modulation signal by adding a modulation to this first modulating signal further according to the second digital information other than the first digital information.

[0006] Moreover, the optical information record approach concerning this invention is set to the optical information record approach which records digital information on an optical information record medium by modulating the record light which irradiates an optical information record medium. The first modulating signal is created by changing signal level with the period of the integral multiple of a predetermined primitive period according to the first digital information. By modulating the timing of level change of this first modulating signal according to the second digital information other than the first digital information, a double modulation signal is created and it is characterized by modulating record light according to this double modulation signal.

[0007] Moreover, the optical information record medium concerning this invention is set to the optical information record medium with which digital information was recorded by forming the truck which consists of a pit or a mark. So that the regenerative signal with which the first digital information changes with the period of the integral multiple of a predetermined primitive period may be acquired It is recorded by changing the die length or spacing of these pits or a mark. The second digital information other than the first digital information is characterized by what is recorded by moving the location of these pits, the first transition of a mark, or a trailing edge from the location determined by the first digital information.

[0008] Moreover, the optical information regenerative apparatus concerning this invention is set to the optical information regenerative apparatus which reproduces digital information from an optical information record medium based on the output of the optical reading means according to the reflected light from an optical information record medium. A binary-ized means to make the output of an optical reading means binary, and a clock generation means to generate a clock signal based on the output of this binary-ized means, The first decode means which decodes the first digital information based on the output of this binary-ized means, It has the second decode means which decodes the second digital information other than the first digital information based on the output of an optical reading means, this clock signal, and the output of this binary-ized means. This second decode means is characterized by including a changing point location detection means to detect time fluctuation of the changing point of the output of a binary-ized means, and an equalization means to

average the output of this changing point location detection means.

[0009] According to the optical information recording device and the optical information record approach concerning above this inventions In case the usual information which a user uses as the first digital information is recorded on an optical information record medium As opposed to the first modulating signal created by changing signal level with the period of the integral multiple of a predetermined primitive period according to this usual information A double modulation signal is created by adding a modulation further according to the second digital information (for example, identification code for discernment of an optical information record medium). And an identification code is recorded with the usual information by modulating record light according to this double modulation signal in the field which records the usual information. Therefore, an identification code is recorded with the usual information in the field which records the usual information, without adding the easy hardware for the conventional recording device, or adding modification to a disk plant entirely only by adding easy modification for the conventional record approach.

[0010] Next, so that the regenerative signal with which the usual information changes with the period of the integral multiple of a predetermined primitive period may be acquired according to the optical information record medium concerning this invention It was recorded by changing the die length or spacing of the pit on a truck, or a mark, and another side and an identification code were recorded by moving the location of these pits, the first transition of a mark, or a trailing edge from the location determined using the usual information, for example. Even if it is going to perform an illegal copy here by the approach of copying physically the pit configuration of this optical information record medium (optical Shinsei information record medium) etc., it is difficult to copy correctly the location of a pit or the first transition of a mark, or a trailing edge. Moreover, by a conventional recording device or the conventional record approach, even if it is going to perform an illegal copy based on the audio signal reproduced from this optical Shinsei information record medium, since the location of a pit or the first transition of a mark, or a trailing edge cannot be moved according to an identification code, the optical information record medium which made the location of a pit or the first transition of a mark, or a trailing edge correctly in agreement with an optical Shinsei information record medium cannot be created. Therefore, creation of the illegal copy which was in agreement with Shinsei optical information record medium and accuracy is prevented. It is possible to reproduce the usual information from this optical information record medium, using the conventional regenerative apparatus as it is. And it also becomes possible to reproduce an identification code from this optical information record medium only by adding the easy hardware for the conventional regenerative apparatus. Furthermore, when the movement magnitude of the location of the first transition of each pit or a trailing edge is very small, it becomes possible to reproduce the usual information, without no being influenced of migration of this location.

[0011] And according to the optical information regenerative apparatus concerning this invention, the usual information is decoded based on the signal which made the output of an optical reading means binary, and an identification code is decoded by equalizing time fluctuation of the changing point of this binary signal based on the output of another side and this optical reading means, this binary signal, and the clock signal generated based on this binary signal. Therefore, only by adding the easy hardware for the conventional regenerative apparatus, the identification code recorded as movement magnitude with very small many pits or location of the first transition of a mark or a trailing edge is stabilized, and is reproduced. Furthermore, since such an identification code is not reproduced, when an identification code is not reproduced, it becomes possible from the optical information record medium concerning an illegal copy to eliminate an illegal copy by suspending playback of the usual information etc.

[0012]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained, referring to an accompanying drawing. In addition, taking the case of a compact disk, it will explain here as an optical information record medium. As everyone knows, a compact disk fabricates a substrate ingredient (plastics) by an injection-molding method etc. by using a stamper as metal mold, creates a disk substrate, and is created by forming the reflective film, a protective coat, etc. on this disk substrate.

[0013] A stamper is created by the following processes. First, a condensing location is moved to radial [of original recording] at constant pitch, making a circumferencial direction rotate this original recording at the same time it condenses the laser beam for record on disk original recording (glass plate of the shape of a disk which applied and dried the photoresist) (cutting). Thereby, the latent image of the truck of the shape of a spiral which consists of a pit is formed in a photoresist. Next, after developing a photoresist, a mother disk is created by electroforming nickel on disk original recording. And the stamper which imprinted the truck pattern on a mother disk is created by exfoliating a nickel layer from a mother disk.

[0014] It is in process and drawing 1 shows an example of the configuration of the optical disk recording device 1 used in order [this] to cut disk original recording. The disk original recording 2 rotates with a spindle motor 4. A spindle motor 4 is controlled by the spindle servo circuit 5.

[0015] FG signal generator which is not illustrated is formed in the pars basilaris ossis occipitalis of a spindle motor 4. From this FG signal generator, FG signal with which signal level starts for every predetermined angle of rotation is outputted. The SUBIN dollar servo circuit 5 rotates disk original recording 2 at the rate of predetermined by driving a spindle motor 4 so that the frequency of this FG signal may turn into predetermined frequency (with for example, constant linear velocity).

[0016] The laser equipment 7 for record injects a laser beam L to an optical

modulator 8. This laser equipment 7 for record consists of for example, gas laser equipment etc. an optical modulator 8 consists of electric acoustooptics components etc. -- having -- the laser beam L which carries out incidence is turned on/off controlled according to the 2nd modulating signal SC supplied from the 2nd modulation circuit 57 from Li and the laser equipment 7 for record
[0017] A mirror 10 turns the optical path to the disk original recording 2 by reflecting the laser beam L which passed through the optical modulator 8. An objective lens 11 condenses the reflected light of this mirror 10 on the recording surface of the disk original recording 2. A mirror 10 and an objective lens 11 move to radial [the] according to the thread device which is not illustrated synchronizing with rotation of the disk original recording 2.
[0018] By moving the condensing location of a laser beam L in the direction of a periphery of the disk original recording 2 at constant pitch according to this thread device, the latent image of the truck of the shape of a spiral which consists of the pit corresponding to the 2nd modulating signal SC is formed on the disk original recording 2.
[0019] From a digital audio tape recorder 3, the audio data D1 which should be recorded on the disk original recording 2 are supplied to a modulation circuit 13. Moreover, sub-code data including the TOC information corresponding to the audio data D1 etc. are also supplied to a modulation circuit 13 from the sub-code generator which is not illustrated.
[0020] A modulation circuit 13 generates the EFM signal S2 by data processing according to a format of a compact disk. That is, after adding an error correcting code to the audio data D1 and sub-code data and interleaving those data, the EFM signal S2 is generated by carrying out an EFM (Eight to Fourteen Modu1ation) modulation.
[0021] In the optical disk recording apparatus used in order to cut disk original recording conventionally, only usual information like audio data or sub-code data was recorded on the disk original recording 2 by carrying out ON/OFF control of the laser beam L as it is by this EFM signal S2 (that is, the latent image of the truck which consists of the pit only corresponding to the EFM signal S2 was formed in the disk original recording 2).
[0022] In the optical disk recording apparatus concerning this invention, a disk identification code is recorded on the record section of the usual information with the usual information so that it may mention later. For this reason, the disk identification code SC 1 generated from the disk identification code generating circuit 51 is supplied to the 2nd modulation circuit 57 with the EFM signal S2. The disk identification code SC 1 is a signal showing the disk identification code which consists of the information which controls ID information set up as a peculiar thing for every disk original recording, the information concerning a manufacture manufacturer, the information concerning a factory place (plant), the date of manufacture, or copy good / failure.

[0023] By superimposing the disk identification code SC 1 on the EFM signal S2, the 2nd modulation circuit 57 generates the 2nd modulating signal SC, and supplies this 2nd modulating signal SC to an optical modulator 8. Therefore, a laser beam L will be turned on/off controlled according to the signal which superimposed the disk identification code SC 1 on the EFM signal S2. In addition, superposition of the disk identification code SC 1 to the EFM signal S2 is performed so that the usual information recorded by the EFM signal S2 may not be spoiled, so that it may mention later.

[0024] The 2nd modulation circuit 57 generates the frame clock FCK other than the 2nd modulating signal SC, and supplies it to the disk identification code generating circuit 51. As shown in drawing 2 A-C, the frame synchronizing pulse of a 22-channel clock is inserted in the EFM signal S2 at every one of a compact disk frame (time amount of the die length for a 588-channel clock of the channel clock CK with a frequency of 4.3218MHz). The frame clock FCK is the clock signal of the low speed which produces 1 time of a pulse for every frame synchronizing pulse of this, as shown in drawing 2 D. The disk identification code generating circuit 51 generates 1 bit of disk identification codes SC 1 at a time synchronizing with this frame clock FCK, as shown in drawing 2 E. Therefore, the disk identification code SC 1 expresses the information for 1 bit for every frame. Thus, the disk identification code SC 1 was made into the signal of a frame unit for simplifying the configuration of the optical disk regenerative apparatus mentioned later.

[0025] Furthermore, in the optical disk regenerative apparatus mentioned later, a disk identification code is decoded only from the polarity-reversals part (part from which a regenerative signal changes to 1 from 0 by changing to the tooth-space part between the pits where the condensing location of the laser beam for playback adjoins each other from a pit, or a pit from a tooth-space part) of a regenerative signal. By the way, by eight-to-fourteen modulation, the signal which a polarity reverses in the range of periods 3T-11T to the predetermined primitive period T (here ** with a period [of the channel clock CK] of 1/4.3218MHz 231ns) is generated as everyone knows. Therefore, also at the lowest in one frame which is the period which judges the disk identification code for 1 bit, the polarity of a regenerative signal will be reversed 588/11**53 times or more. Thus, since decode is performed in many polarity-reversals parts to the disk identification code for 1 bit, it becomes possible to decode a disk identification code with sufficient S/N in an optical disk regenerative apparatus.

[0026] Drawing 3 shows an example of the configuration of the 2nd modulation circuit 57. Moreover, drawing 4 is a timing chart which shows an example of the relation of the timing of the signal in each part of the 2nd modulation circuit 57. In drawing 3 , the EFM signal S2 supplied to the 2nd modulation circuit 57 is inputted into monostable multivibrators 25A and 25B. Monostable multivibrator 25A detects the rising edge of the EFM signal S2, starts, and outputs the edge detection pulse MMS (refer to drawing 4 A and C). Monostable multivibrator 25B detects the falling edge of

the EFM signal S2, and outputs the falling edge detection pulse MMR (refer to drawing 4 A and D). While the edge detection pulse MMS is sent to one selection input terminal of data selector 23A, through delay circuit 26A of a predetermined time delay (about 5ns as an example), while will data-selector 23A Accept it, and it is sent to a selection input terminal. While the falling edge detection pulse MMR is sent to one selection input terminal of data selector 23B, through delay circuit 26B of a predetermined time delay (about 5ns as an example), while will data-selector 23B Accept it, and it is sent to a selection input terminal. Data selector 23A is the control signal MS 1 (so that it may mention later) from an IKUSUKURUSHIBU OR circuit. the signal which enciphered the disk identification code SC 1 with the M sequence sign MS -- it is -- it being supplied as a selection-control signal, and, when the value of a control signal MS 1 is 1 Start, choose the edge detection pulse MMS, output as a rising edge pulse SS, and when [whose value of a control signal MS 1 is 0 conversely] delayed by delay circuit 26A The rising edge detection pulse MMS without delay from monostable multivibrator 25A is chosen, and it outputs as a rising edge pulse SS (refer to drawing 4 C and G and H). The signal to which data selector 23B reversed the control signal MS 1 with the inverter 34 is supplied as a selection-control signal. When the value of this reversal signal is 1, (namely, when the value of a control signal MS 1 is 0) Choose the falling edge detection pulse MMR delayed by delay circuit 26B, and it outputs as a falling edge pulse RR. Conversely, when the value of this reversal signal is 0, the falling edge detection pulse MMR without delay from monostable multivibrator 25B is chosen, and it outputs as a falling edge pulse RR (refer to drawing 4 D and G and I). (namely, when the value of a control signal MS 1 is 1)

[0027] Thus, the rising edge pulse SS and the falling edge pulse RR are created by giving delay to the part specified with the control signal MS 1 among the rising edge of the EFM signal S2, and the falling edge. These rising edge pulses SS and the falling edge pulse RR are reconfigurated by the EFM signal by the set reset flip flop 24. That is, the rising edge pulse SS is inputted into the set input terminal S of a set reset flip flop 24, and the falling edge pulse RR is inputted into the reset input terminal R of a set reset flip flop 24. Thereby, from a set reset flip flop 24, after level starts in the standup of the rising edge pulse SS, the signal SC with which level falls in falling of the falling edge pulse RR is outputted (refer to drawing 4 H-J). Thus, delay is given to the edge specified with the control signal MS 1 although the reconfigurated EFM signal (the 2nd modulating signal) SC is carrying out the almost same wave as the EFM signal S2.

[0028] As mentioned above, to being delayed when the value of a control signal MS 1 is 1, the rising edge pulse SS is delayed, when the value of a control signal MS 1 of the falling edge pulse RR is 0. Thus, delay processing to the rising edge pulse SS and delay processing to the falling edge pulse RR were reversely carried out for making it possible to decode a disk identification code in the optical disk regenerative apparatus

mentioned later, without distinguishing the standup and falling of an edge of a regenerative signal.

[0029] IKUSUKURUSHIBU OR circuit 33 enciphers the disk identification code SC 1 with the M sequence sign (maximum length sequence sign) MS from the M sequence generating circuit 32, and outputs it as a control signal MS 1. The M sequence generating circuit 32 generates the M sequence sign MS by making into a unit the channel clock CK (referring to drawing 2 C and drawing 4 B) created by the PLL circuit 30 based on the EFM signal S2, and is initialized by the detection output signal FCK (refer to drawing 2 D) of the alignment pattern of the EFM signal S2 by the synchronous detector 31. Consequently, the M sequence sign MS turns into a signal which repeats the same pattern with the period of one frame (588-channel clock). Although it consists of two or more flip-flops and IKUSUKURUSHIBU OR circuits by which cascade connection was carried out, since the configuration and principle of operation are common knowledge, the M sequence generating circuit 32 omits detailed explanation.

[0030] Thus, as the 2nd acquired modulating signal SC was shown also in drawing 4 J, the edge is delayed partially. Namely, when the disk identification code SC 1 is 0 and the M sequence sign MS is 1, delay is given, and as for the rising edge of Signal SC, delay is given, when the disk identification code SC 1 is 1 and the M sequence sign MS is 0. On the other hand, when the disk identification code SC 1 is 0 and the M sequence sign MS is 0, delay is given, and as for the falling edge of Signal SC, delay is given, when the disk identification code SC is 1 and the M sequence sign MS 1 is 1. If it puts in another way, the disk identification code SC 1 enciphered by the M sequence sign MS is expressed as a time amount gap of the edge of Signal SC. In the optical disk regenerative apparatus mentioned later, the compact disk to which record was performed by such approach is played, and the disk identification code SC 1 is decoded based on sampling to the timing of the clock signal which generated the amplitude in the polarity-reversals part of a playback RF signal based on the playback RF signal.

[0031] As mentioned above, the amount of delay of the edge of the signal SC for expressing a disk identification code is set as very few amounts of 5ns. Considering that the primitive period T of a compact disk (period of the channel clock CK) is about 231ns as mentioned above, time variation of this level is fully within the limits of an allowable error, and in order to decode the usual information, such as audio data, it turns out that it has no effect. Moreover, when this time amount for 5ns was converted into the movement magnitude of the location of the edge of the pit on a disk and record is performed by linear-velocity 1.2 m/sec, it turns out that it is a very small amount of 6nm slightly. And although each amount of delay is very small in this way, since a 1-bit disk identification code is expressed as an amount of delay of many 1 inter-frame edges, it is possible to decode a disk identification code with sufficient S/N in an optical disk regenerative apparatus as mentioned above.

[0032] While audio data and sub-code data are recorded on the disk original recording 2 by changing the die length or spacing of a pit by carrying out ON/OFF control of the laser beam L with an optical modulator 8 according to the 2nd above modulating signal SC, a disk identification code is recorded by moving the location of the first transition of a pit, or a trailing edge to the record section of audio data or sub-code data from the location determined with audio data or sub-code data. Therefore, it was recorded on the record section of audio data or sub-code data from this disk original recording completely similarly [a mother disk and the compact disk created through creation of a stamper / a disk identification code].

[0033] In addition, when an example of the configuration of the disk identification code generating circuit 51 is shown, it is as drawing 5 . The frame clock FCK supplied from the 2nd modulation circuit 57 is counted with the N-ary counter 54 which used the ring counter, and the counted value signal CT 1 is inputted into the disk identification code table 55.

[0034] The disk identification code table 55 consists of ROMs which stored bit information, and outputs bit information by considering the counted value signal CT 1 as an address input. The information for correcting the error of the synchronizing signal showing the beginning of a disk identification code other than the disk identification code itself and the sign generated in the disk identification code etc. is included in this bit information.

[0035] Next, with reference to drawing 6 thru/or drawing 8 , the optical disk regenerative apparatus 150 which plays the compact disk 41 with which record was performed as mentioned above is explained. In drawing 6 , a spindle motor 151 rotates the basis of control of the servo circuit 152, and a compact disk 41 at the rate of predetermined (with for example, constant linear velocity). Optical pick ABBU 153 irradiates the laser beam for playback at the basis of the tracking control by the servo circuit 152, and focal control, and a compact disk 41, and generates the playback RF signal of level according to the amount of reflected lights. This playback RF signal is supplied to the binary-ized circuit 154 and the disk identification code decoder circuit 170.

[0036] The binary-ized circuit 154 changes that signal level into binary-signal BD of 1 or 0 as compared with predetermined slice level, after carrying out waveform equalization of this playback RF signal (refer to drawing 8 A and B). This binary-signal BD is supplied to the EFM demodulator circuit 156, the PLL section 155, and the disk identification code decoder circuit 170. The EFM demodulator circuit 156 restores to binary-signal BD, and supplies the signal of 8 bitwises which generated and generated the signal of 8 bitwises to the ECC circuit 157.

[0037] The ECC circuit 157 performs processing which corrects the error of the sign based on the error correcting code added to the signal, after carrying out day interleave processing of the signal from the EFM demodulator circuit 156. The error of such a sign originates in the blemish for example, on a compact disk 41 etc., and is

produced. The output signal of the ECC circuit 157 is changed into the audio signal of an analog with D/A converter 158.

[0038] The PLL section 155 generates the channel clock CCK (refer to drawing 8 C) based on binary-signal BD. This channel clock CCK is supplied to the EFM demodulator circuit 156 and the disk identification code decoder circuit 170, and directs the timing of these circuits of operation.

[0039] On the other hand, the disk identification code decoder circuit 170 decodes a disk identification code based on three signals CCK, i.e., the channel clock, binary-signal BD, and the playback RF signal which are supplied. The decoded disk identification code is supplied to the microcomputer CPU 159 which controls actuation of the whole optical disk regenerative apparatus 150. CPU159 suspends playback of an audio signal by judging that it is what requires a compact disk 41 for an illegal copy, and not supplying the enable signal to D/A converter 158 which carries out analogue conversion of the output signal of the ECC circuit 157, when a right disk identification code is not supplied.

[0040] Drawing 7 shows an example of the configuration of the disk identification code decoder circuit 170. A/D converter 171 is the timing defined with the channel clock CCK, and changes a playback RF signal into a 8-bit digital RF signal. This digital RF signal is sent to another selection input terminal of the back data selector 173 with which the polarity was reversed by the polarity-reversals circuit 172 while it is sent to one selection input terminal of a data selector 173. A data selector 173 chooses by making into a selection-control signal the M sequence sign MZ restored by the M sequence generation circuit 179. That is, a data selector 173 chooses the digital RF signal by which polarity reversals are not carried out from A/D converter 171, when the value of the M sequence sign MZ is 1, and when the value of the M sequence sign MZ is 0, it chooses the digital RF signal by which polarity reversals were carried out in the polarity-reversals circuit 172. Thus, in a data selector 173, the product of the M sequence sign MZ and a digital RF signal calculates. The output signal of the data selector 173 showing this product RX is added with the output signal of an accumulator 175 in an adder 174 so that it may mention later.

[0041] After the alignment pattern detector 178 detects the frame synchronizing pulse (refer to drawing 8 A and B) in every frame from binary-signal BD and the channel clock CCK and carries out 1 pulse output of the set pulse FSET to the beginning of each frame, it is slightly overdue and carries out 1 pulse output of the clear pulse FCLR (refer to drawing 8 E and D). The clear pulse FCLR is supplied to the M sequence generation circuit 179, an accumulator 175, and the edge counter 183, and a set pulse FSET is supplied to the binary-ized circuit 181 and the ECC circuit 182. From binary-signal BD and the channel clock CCK, the edge detector 180 falls with the standup part of a playback RF signal, and detects both parts. The edge detecting signal outputted from the edge detector 180 is supplied to an accumulator 175 and the edge counter 183.

[0042] An adder 174 is a 16-bit digital adder, and adds the output value RX of a data selector 173, and the output value of an accumulator 175. The accumulator 175 consists of 16-bit memory, from the edge detector 180, is as a result of [of an adder 174] addition, and replaces the value AX which is the timing to which the edge detecting signal was supplied, and was held till then while it outputs the signal showing the value AX currently held in memory. That is, whenever the polarity of a playback RF signal is reversed, the operation of AX=AX+RX will be performed in an accumulator 175. Moreover, an accumulator 175 will clear to 0 the value AX currently held till then, if the clear pulse FCLR is supplied from the alignment pattern detector 178.
[0043] Therefore, when the output signal of an accumulator 175 is observed to the timing which the set pulse signal FSET produces from the alignment pattern detector 178, it expresses the accumulation value of the amplitude in the edge part (polar change part) of the playback RF signal covering one last frame (between 588-channel clocks).
[0044] The edge counter 183 is the timing to which the edge detecting signal was supplied from the edge detector 180, and increments counted value NX every [1]. Moreover, the edge counter 183 will clear the counted value NX till then to 0, if the clear pulse FCLR is supplied from the alignment pattern detector 178. Therefore, when the output signal of the edge counter 183 showing this counted value NX is observed to the timing which the set pulse signal FSET produces from the alignment pattern detector 178, it expresses the number of the edges of the playback RF signal in one last frame (namely, count by which the amplitude of a playback RF signal was accumulated in one last frame).
[0045] The digital divider 176 does the division of the output value of an accumulator 175 with the output value of the edge counter 183. Therefore, when the digital signal BX outputted from the digital divider 176 is observed to the timing which the set pulse signal FSET produces from the alignment pattern detector 178, it expresses the average of the amplitude in the polar change part of the playback RF signal covering one last frame. This average value is reflecting therefore, the disk identification code 1 in the frame concerned (SC) for the movement magnitude of the location of the first transition of the pit on the disk 41 in the frame concerned, or a trailing edge.
[0046] Thus, the digital signal BX searched for as an average value of the amplitude in many polar change parts is seldom influenced of the random noise contained in a playback RF signal. Therefore, as mentioned above, even if the movement magnitude of the location of the first transition of each pit or a trailing edge is very small, it can decode a disk identification code with sufficient S/N based on a digital signal BX. And since the movement magnitude of the location of the first transition of each pit or a trailing edge is very small (within the limits of an allowable error), the usual information, such as audio data, can be decoded, without no being influenced of migration of this location.

[0047] The binary-ized circuit 181 changes this digital signal BX into the binary signal of 1 or 0 from the alignment pattern detector 178 for every timing to which the set signal FSET was supplied as compared with predetermined slice level (namely, just before an accumulator 175 and the edge counter 183 are cleared by the clear pulse FCLR). When Shinsei [a disk 41] (it is not an illegal copy), if this binary signal removes the point of the error of a sign, it serves as the disk identification code SC 1 and match which were recorded on the creation time of a disk 41.
[0048] The ECC circuit 182 performs processing which corrects the error of that sign based on the error correcting code added to this binary signal. The output signal of this ECC circuit 182 is sent to CPU159 as a disk identification code finally decoded.
[0049] In addition, although this invention is applied to the recording device and the regenerative apparatus which adopted EFM as modulation techniques, such as audio data, in the above example, this invention is applicable to the recording device and regenerative apparatus which adopted almost all modulation techniques, such as not only this but 1-7 modulation, and 8-16, 2-7 modulation.
[0050] moreover, in the above example, an EFM signal is modulated by being delayed on an edge -- **** (that is, the timing of level change of an EFM signal is modulated) -- you may make it modulate an EFM signal by proper approaches -- this invention fluctuates the output of for example, not only this but the laser beam for record --
[0051] Moreover, although the disk identification code is recorded on the record section of audio data as movement magnitude of the location of the first transition of a pit, or a trailing edge in the above example, this invention may record a disk identification code on the record section of not only this but TOC as movement magnitude of the location of the first transition of a pit, or a trailing edge.
[0052] Moreover, although this invention is applied to the recording device and the regenerative apparatus which enciphers a disk identification code with an M sequence sign in the above example, this invention may be applied to the recording device and regenerative apparatus which enciphers a disk identification code with the signal of sequences not only this but other than an M sequence sign, and the recording device and regenerative apparatus which do not encipher a disk identification code. Moreover, when applying to the recording device and regenerative apparatus which enciphers a disk identification code, you may make it also record and reproduce the signal used for encryption as movement magnitude of the location of the first transition of a pit, or a trailing edge.
[0053] Moreover, although it has judged whether it is an illegal copy only based on the disk identification code which enciphered with the M sequence sign and was recorded as movement magnitude of the location of the first transition of a pit, or a trailing edge in the above example This invention judges whether it is an illegal copy by collating not only with this but the disk identification code recorded, for example by the proper approach, or it [it] You may make it judge whether it is an illegal copy by various approaches, such as judging whether it is an illegal copy by collating with the

disk identification code enciphered with the signal of sequences other than an M sequence sign.

[0054] Moreover, although this invention is applied to the recording device and the regenerative apparatus of a compact disk in the above example, this invention is applicable to the optical disk of the various kinds which record information not only by this but by the pit, the magneto-optic disk which records information by the mark.

[0055]

[Effect of the Invention] As mentioned above, according to the optical information recording device and the optical information record approach concerning this invention In case the usual information which a user uses as the first digital information is recorded on an optical information record medium As opposed to the first modulating signal created by changing signal level with the period of the integral multiple of a predetermined primitive period according to this usual information A double modulation signal is created by adding a modulation further according to the second digital information (for example, identification code for discernment of an optical information record medium). And an identification code is recorded with the usual information by modulating record light according to this double modulation signal in the field which records the usual information. Therefore, an identification code can be recorded with the usual information in the field which records the usual information, without adding the easy hardware for the conventional recording device, or adding modification to a disk plant entirely only by adding easy modification for the conventional record approach.

[0056] Next, according to the optical information record medium concerning this invention, it is recorded by changing the die length or spacing of the pit on a truck, or a mark, and when another side and an identification code move the location of these pits, the first transition of a mark, or a trailing edge from the location determined using the usual information, for example, the usual information is recorded so that the regenerative signal which changes with the period of the integral multiple of a predetermined primitive period may be acquired. Even if it is going to perform an illegal copy by the approach of copying physically the pit configuration of this optical information record medium (optical Shinsei information record medium) etc., it is difficult to copy correctly a pit or the first transition of a mark, the location of a trailing edge, etc. other ** -- even if it is going to perform an illegal copy based on the audio signal reproduced from this optical Shinsei information record medium, since the location of a pit or the first transition of a mark, or a trailing edge cannot be moved according to an identification code by a conventional recording device or the conventional record approach, the optical information record medium which made the location of a pit or the first transition of a mark, or a trailing edge correctly in agreement with an optical Shinsei information record medium cannot be created. Therefore, creation of the illegal copy which was correctly in agreement with the optical Shinsei information record medium can be prevented. It is possible to

reproduce the usual information from this optical information record medium, using the conventional regenerative apparatus as it is. And it also becomes possible to reproduce an identification code from this optical information record medium only by adding the easy hardware for the conventional regenerative apparatus. Furthermore, when the movement magnitude of the location of the first transition of each pit or a trailing edge is very small, it becomes possible to reproduce the usual information, without no being influenced of migration of this location.

[0057] Next, according to the optical information regenerative apparatus concerning this invention, the usual information is decoded based on the signal which made the output of an optical reading means binary, and an identification code is decoded by equalizing time fluctuation of the changing point of this binary signal based on the output of another side and this optical reading means, this binary signal, and the clock signal generated based on this binary signal. Therefore, only by adding the easy hardware for the conventional regenerative apparatus, it is stabilized and the identification code recorded as movement magnitude with very small many pits or location of the first transition of a mark or a trailing edge can be reproduced. Furthermore, since such an identification code is not reproduced from the optical information record medium concerning an illegal copy, when an identification code is not reproduced, an illegal copy can be eliminated by suspending playback of an audio signal etc.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing an example of the configuration of the optical disk recording apparatus concerning this invention.

[Drawing 2] It is the timing chart which shows the timing of the signal in each part of the equipment of drawing 1 .

[Drawing 3] It is the block diagram showing an example of the configuration of the 2nd modulation circuit of drawing 1 .

[Drawing 4] It is the timing chart which shows the timing of the signal in each part of the circuit of drawing 3 .

[Drawing 5] It is the block diagram showing an example of the configuration of the disk identification code generating circuit of drawing 1 .

[Drawing 6] It is the block diagram showing an example of the configuration of the optical disk regenerative apparatus concerning this invention.

[Drawing 7] It is the block diagram showing the configuration of the disk identification code decoder circuit of drawing 6 .

[Drawing 8] It is the timing chart which shows the timing of the signal in each part of the circuit of drawing 7 .

[Description of Notations]

1 Optical Disk Recording Apparatus, 13 Modulation Circuit, 41 Compact Disk, 51 Disk Identification Code Generating Circuit, 57 2nd Modulation Circuit, 150 Optical Disk Regenerative Apparatus, 152 Servo Circuit, 153 Optical Pickup, 156 EFM Demodulator Circuit, 170 Disk Identification Code Decoder Circuit 2 Disk Original Recording 4,151 Spindle Motor 5 Spindle Servo Circuit 7 Laser Equipment for Record 8 Optical Modulator